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猪科化石一新种在内蒙古上始新统的发现[1)]

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摘要 记述了在我国内蒙古沙拉木仑地区晚始新世乌兰戈楚组中发现的猪科化石——内蒙古短面猪(新种)(*Brachyhyops neimongolensis* sp. nov.)。新种的主要特征是:下颌骨深,前臼齿部分更缩短,下缘明显斜向前上方,颊齿主尖高锐,脊形,上臼齿梯形,已形成原脊,原尖位置靠后,M3具次尖,后齿带弱。研究表明 *Eoentelodon* 和 *Brachyhyops* 在下颌骨具骨质突起的刍形,前部缩短,下颌骨联合达p3,p3与p4彼此紧靠,下臼齿的下前尖与下后尖明显分开,以及上颊齿的形态上都很接近。*Eoentelodon* 为 *Brachyhyops* 的后出同物异名。

关键词 内蒙古沙拉木仑地区,晚始新世,猪科
中图法分类号 Q915.876

猪科(Entelodontidae,又称猪齿兽科或"巨猪科")是一类已绝灭的大型偶蹄类动物,头骨面部通常伸得很长,在颧弓外缘和下颌骨下缘有骨质突起;颈短,躯干中等,尾短。该科已知分布于全北区。它们在亚洲和北美生存的时代较长,从中始新世到中新世,在欧洲仅在渐新世时出现。

2001年5～6月,笔者应美国纽约自然历史博物馆古生物部R. H. Tedford博士的邀请赴该馆访问研究。在访问期间,我们考察了该馆中亚考察团于上一世纪20年代所采集的化石。其中有几件猪类化石的标本,是1928年在我国内蒙古沙拉木仑地区的晚始新世乌兰戈楚组中发现的。这批化石在过去的文献中从未有人提及过。实际上,这批化石对亚洲晚始新世猪类的分类地位以及亚洲与北美猪类的关系提供了重要的信息。感谢美国自然历史博物馆的同事们,他们毫无保留地同意我们对这批标本进行研究并在我国的刊物上发表。

猪科 Entelodontidae Lydekker, 1883
短面猪 Brachyhyops Colbert, 1938

Eoentelodon Chow 1958, 30～36, fig.1, p1.I

评述 短面猪属(*Brachyhyops*)是Colbert(1938)建立的。属型种(*B. wyomingensis*)的正型标本为一件较完好的头骨,建种时并无下颌材料。周明镇(1958)根据产自我国云南路南的标本也建了一个新属、种:云南原始猪(*Eoentelodon yunnanense*,又称云南原始猪齿兽)。该属的材料仅有下颌,而无上颌。周明镇在建立该种时并未与 *Brachyhyops* 比较。Wilson(1971)将美国Texas和Utah州的一些标本归入 *Brachyhyops wyomingensis*。材料中既有上颌骨,也有下颌骨。这使我们对该种的上、下颌和颊齿的特征有了更多的了解。

1) 中国科学院知识创新工程项目(批准号:KZCX2-102)资助。
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Wilson 虽提到 *Eoentelodon yunnanense* ,但没有深入探讨这两个属的关系。他认为 *E. yunnanense* 的个体要比 *B. wyomingensis* 的小 ,但该标本缺下颌联合部分 ,无法判断其伸长的情况。Dashzeveg(1976) 建立了一个产自蒙古的原始猯特氏新种(*Eoentelodon trofimovi*) ,标本包括两段下颌骨(分别具 m2 - 3 和 m1 - 2) 和一枚 M3。虽然这个 M3 与 *Brachyhyops wyomingensis* 的在形态上很接近 ,但 Dashzeveg 并未提及 *Brachyhyops* 属。稍后 , Russell (1980) 描述了产自加拿大 Saskatchewan 州的 *Brachyhyops ? viensis* , 并第一次涉及到 *Brachyhyops* 与 *Eoentelodon* 的关系。他指出 ,除了大小不同外 , *Brachyhyops ? viensis* 在下颌和颊齿的形态上与 *Eoentelodon yunnanense* 非常接近。他曾试图将 Saskatchewan 的标本作为 *Eoentelodon* 的一个种对待。

比较了上述所有有关材料后 ,我们得出了和 Russell (1980) 同样的结论 ,即 *Brachyhyops* 和 *Eoentelodon* 两属在下颌骨和下颊齿的形态上没有什么显著的区别。它们的下颌骨均具骨质突起的刍形 ,下颌骨前部都缩短 ,下颌骨联合达 p3 ,p3 和 p4 紧密排列 ,下臼齿的下前尖和下后尖明显分开等。这些都是猯科其他属所没有的。此外 ,我们还发现这两属的 M3 也非常接近。它们都是横宽的三角形 ,前尖与原尖大小相近 ,后尖退化 ,具明显的小尖 ,齿带很发达并围绕整个牙齿等。Russell (1980) 认为这两属在大小上不同。事实上 ,这种差别很小。如 *Eoentelodon yunnanense* 的颊齿仅比 *Brachyhyops wyomingensis* 的稍小 ,而且二者的 m2 的长度还相近等 , 而 *Eoentelodon trofimovi* 的颊齿比 *Brachyhyops wyomingensis* 的还大些(详见表 1) 。大小上的这种微小的差别显然不能成为建属的依据。因此 , 我们认为 , *Eoentelodon* 为 *Brachyhyops* 的后出同物异名。这样 , *Brachyhyops* 就包括 *B. wyomingensis*、 *B. yunnanensis*、 *B. trofimovi* 和 *B. viensis* 4 个种了。

内蒙古短面猯(新种)

Brachyhyops neimongolensis **sp. nov.**

(图 1～4)

正型标本　右上颌骨具 P4 - M3[AM (= AMNH , 以下同) 99666 , field no. 666]。

归入标本　可能属同一个体的左上颌骨具 dP3 - 4、M1 和左下颌骨具 m1 - 2(AM 26264 ,field no. 666) ;右下颌

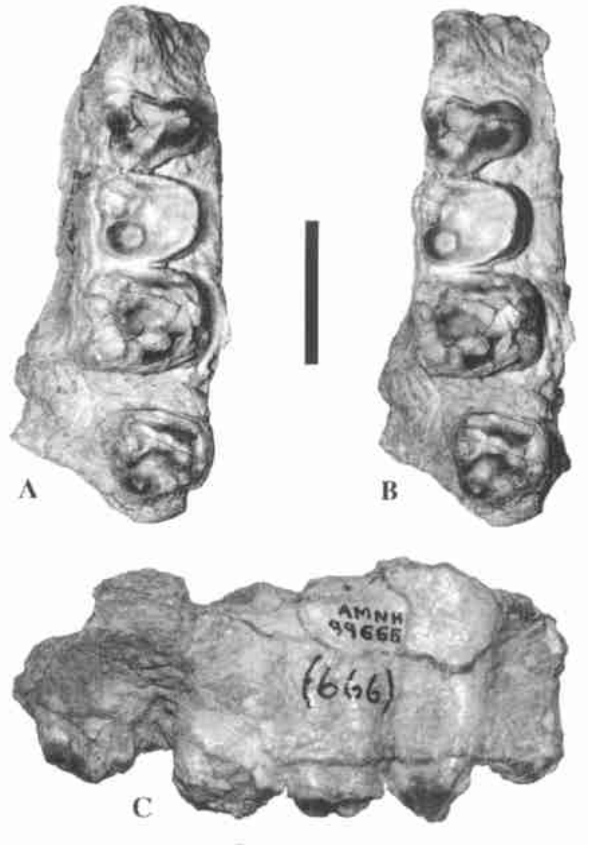


图 1　内蒙古短面猯(新种)右上颌骨具 P4 - M3(AM 99666 ,正型标本)

Fig. 1　Right upper jaw with P4 - M3(AM 99666 , holotype) of *Brachyhyops neimongolensis* sp. nov.

A ,B. 冠面观 ,立体照片(occlusal view ,stereo) ; C. 颊面观(buccal view) ,标尺(scale) = 2cm

骨前部具 dc、p1、dp2 - 4 (AM 99670 ,field no. 668) ;左下颌骨前部具 c-p2 和 p3 齿根(AM 99671 ,field no. 668) 。

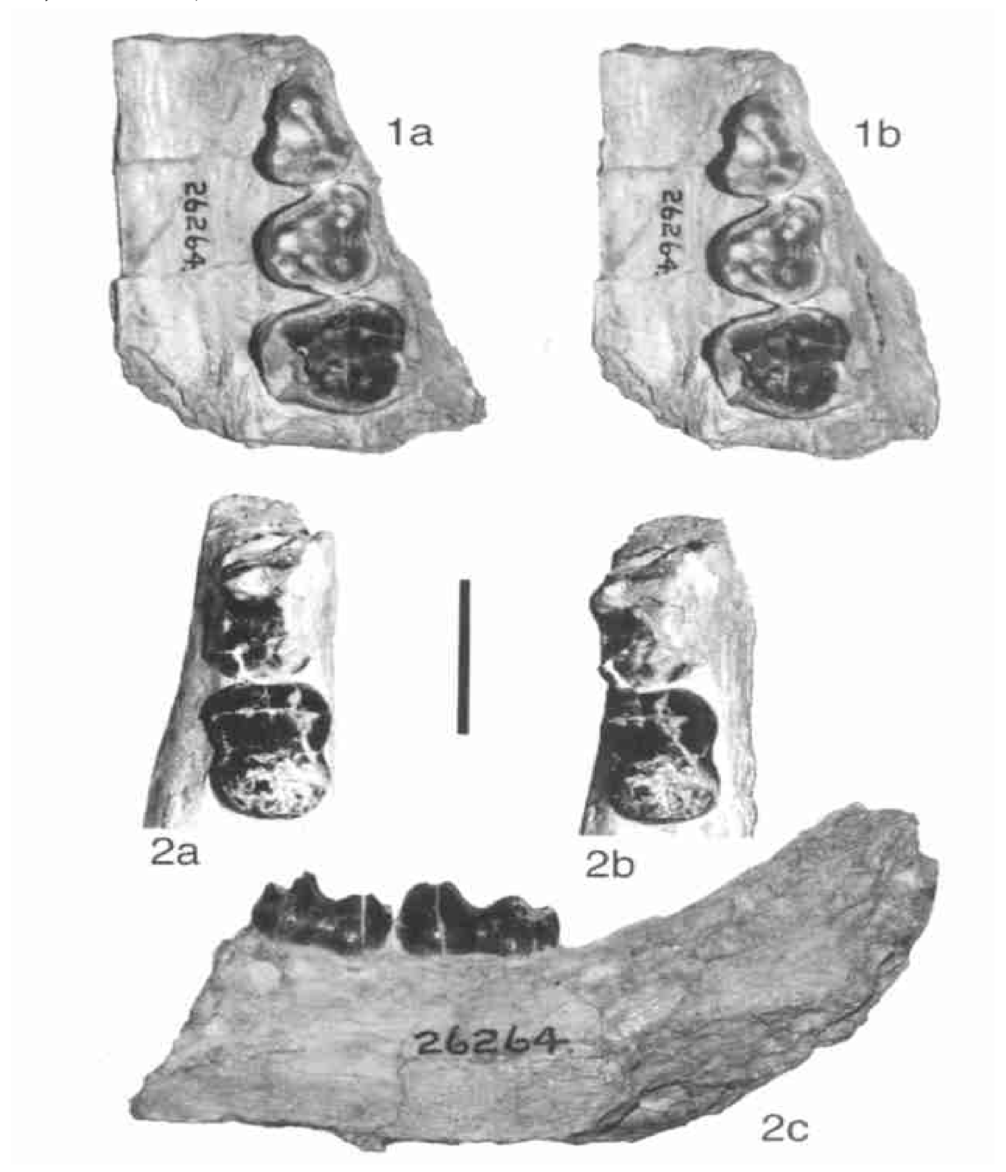


图 2 内蒙古短面猯 (新种) (AM 26264)

Fig. 2 *Brachyhyops neimongolensis* sp. nov. (AM 26264)

1a ,b. 左上颌骨具 dP3 - M1 (left upper jaw with dP3 - M1) ,冠面观 ,立体照片(occlusal view , stereo) ;2a ,b. 左下颌骨具 m1 - 2 (left lower jaw with m1 - 2) ,冠面观 ,立体照片(occlusal view , stereo) ,2c. 左侧面观(left lateral view) , 标尺(scale) = 2cm

地点和层位 中国内蒙古沙拉木仑地区东台地(East Mesa)双敖包(Twin Obo) ;晚始新世乌兰戈楚组。

鉴定特征 中等大小 ;下颌骨水平支较深 ,前部明显缩短 ,其下缘较陡 ;c 和下前臼齿

呈覆瓦状排列;颊齿主尖较高锐,齿脊相对较发达;上臼齿通常为梯形,原尖位置较后,具原脊;M3 前尖和原尖相对较小,具次尖,后齿带弱。

名称来源　*Nei Mongol*,内蒙古,化石产出地区。

描述　上颌骨颊面齿槽缘上方较陡,与颊齿冠面近于垂直。颧弓虽未保存,根据保存的部分上颌骨判断,颧弓突的位置比较高,至少在高于颊齿缘的 30mm 处伸出。眶下孔的位置也较高。下颌骨前部短而深,其下缘向前上方斜,从 p2 下方往前,明显变陡。下颌骨联合后缘达 p3(dp3)。具二颏孔,前者大,位于 p1 后下方;后者小,位于 p3 后部下方。下犬齿 c 和前臼齿列缩短。c - p3呈覆瓦状排列:每个牙齿的纵向长轴呈前舌 - 后颊向伸,后面的牙齿的前部位于其前面牙齿的舌侧。p3 和 p4 彼此紧密相连。

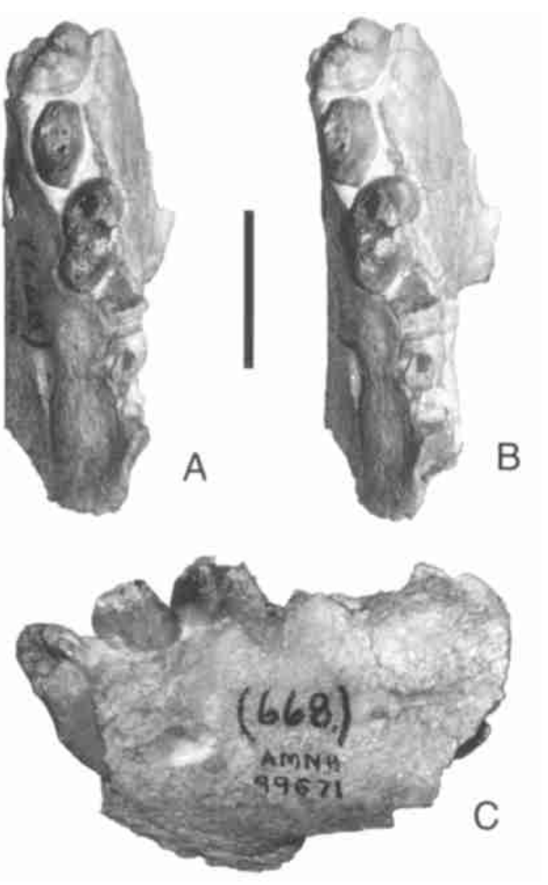


图 3　内蒙古短面猯(新种)左下颌骨前部,具 c-p2(AM 99671)

Fig. 3　Anterior part of left lower jaw with c-p2 of *Brachyhyops neimongolensis* sp. nov. (AM 99671)

A,B. 冠面观,立体照片(occlusal view, stereo);C. 左侧面观(left lateral view),标尺(scale) = 2cm

颊齿的主尖较高而锐。P4 冠面为横宽浑圆的三角形,三侧缘稍凹。前尖部分破损。但从保存的部分看,前尖大于原尖。前尖有前、后棱,分别伸达前、后齿带。齿带在齿的前、颊和后侧存在,在舌侧是否存在不清楚。M1 和 M2 的冠面约为梯形,外缘长于内缘,宽稍大于长。M1 明显小于 M2。AM 99666 的 M1 和 M2 的冠面部分破损,但 AM 26264 的 M1 保存较好,仅原尖处破损。M1 和 M2 的前尖和后尖为丘形,彼此大小相近。原尖较前、后尖稍大,位置不与前尖和原小尖在同一线上,而较靠后,近于舌侧中部。原小尖和后小尖明显。磨蚀后可见有原脊。次尖的情况不清楚。齿带在前、颊、后缘发育,而在舌侧缺。M3 冠面为四边形,冠面结构与 M1/2 的相似,具明显的原脊,但后尖明显比前尖小而低,后小尖也比原小尖低小。具小的次尖。后齿带较弱小。dP3 冠面约为长大于宽的三角形。前尖位于齿的前端,比后尖稍高大,二尖有弱的外脊连。后尖后外侧有弱棱伸达齿带。原尖丘形,有弱的后脊与后尖连。外齿带和后齿带连续发育,缺内齿带。dP4 冠面为梯形,外缘长于内缘,前缘斜向前颊侧伸。前尖和后尖均为丘形,大小相近,有弱的外脊连接,并有弱的棱向舌侧伸。原小尖和后小尖明显,彼此大小相近。原小尖有弱棱伸达前尖的舌侧棱。后小尖有二条细棱,一条伸达后尖的舌侧棱,另一条伸达后尖的后基部。原尖较大,也有棱分别伸向原小尖和后小尖,但不与该二小尖连。次尖位于原尖的后舌侧齿带上,较低小。具明显的前附尖。

齿带沿齿的前、外和后缘连续延伸,仅在原尖舌侧中断。

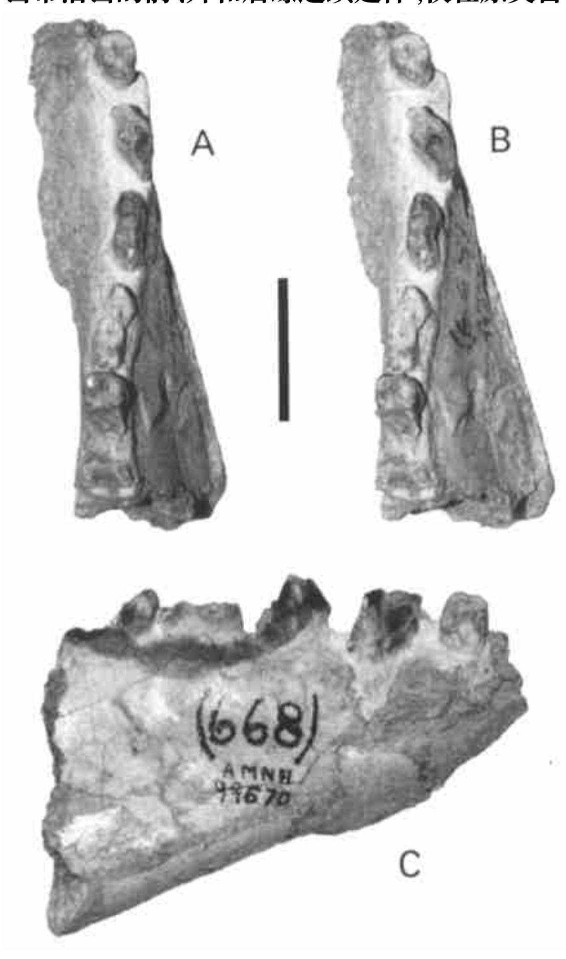


图4 内蒙古短面貒(新种)右下颌骨前部,具dc、p1和dp2 - dp4(AM 99670)

Fig.4 Anterior part of left lower jaw with dc,p1,dp2 - dp4 of *Brachyhyops neimongolensis* sp. nov. (AM 99670)
A,B. 冠面观,立体照片(occlusal view, stereo); C. 右侧面观(right lateral view),标尺(scale) = 2cm

下犬齿c主要保存了根部,较粗壮,横切面为卵圆形。p1扁锥形,主尖(尖顶已破损)横向压扁,呈叶片状。其前、后有明显的棱。棱的基部稍向舌侧弯,并稍膨大。后棱稍长于前棱,坡度稍缓。p2较p1粗壮,顶端破损。其后坡更长,较缓的基部似有或多或少明显的齿带。dc比c和p1小得多,仅保存了齿冠基部,横切面为卵圆形,中有卵圆形的髓腔。dp2与p2相似,但明显较弱小,后缘跟座上的齿带也弱小。dp3只保存了三角座的基部和跟座部分。齿冠窄长。跟座比p2和dp2的发育,上有纵棱和较发育的后齿带。dp4只保存了齿冠的前1/3部分。齿冠也很窄长。下原尖和下后尖大小相近。下后尖位置稍靠前,有弱棱连接前齿带。m1和m2冠面约为长方形。m1冠面部分破损。m2保存较完好,比m1稍大。m2的下三角座高于下跟座,下前尖和下后尖较高而尖,明显高于下原尖,与后者有明显的沟相隔。下前尖和下后尖明显分开,下前尖比下后尖稍高大。下后脊低而浑圆。钝圆的下内尖和下次尖大小相近,只是位置稍靠后。下次尖有斜脊伸达下前尖后基部。下次小尖发育,有弱脊与下内尖连。具前齿带。外齿带在下原尖之后发育,伸达下次小尖。m1与m2的相似,只是下次小尖弱小,外齿带仅在下原尖和下次尖间发育。

测量 见表1。

比较和讨论 内蒙古的标本在下颌骨和颊齿的结构上都与*Brachyhyops*的一致(特征见上)。因此我们把内蒙古的标本归入*Brachyhyops*属。但内蒙古的标本的颊齿主尖较高而锐和更脊形化等特征与*Brachyhyops*属的已知4种都有明显的区别。此外,它们与*B. wyomingensis*和*B. viensis*的区别还在于其上臼齿为梯形,原脊已形成,原尖的位置较靠后等。它们与*B. wyomingensis*和*B. trofimovi*的区别在于其M3为四边形,具次尖,后齿带弱;而与*B. wyomingensis*的区别还在于其P4更宽短;与*B. yunnanensis*和*B. viensis*的区别在于下颌骨水平支相对较高,前部下缘较短而陡;与*B. viensis*的区别还在于个体较小等。

表 1　短面猯属各种的颊齿测量比较

Table 1　Measurements and comparison of the cheek teeth of the species of *Brachyhyops* **(mm)**

	B. neimongolensis sp. nov.				*B. wyomingensis*	*B. yunnanensis*	*B. trofimovi*	*B. viensis*
	AM 26264	AM 99666 (holotype)	AM 99670	AM 99671	Colbert, 1938[1)]	Chow, 1958[2)]	Dashzeveg, 1976[3)]	Russell, 1980[4)]
P3 - M3L		61.4						
M1 - 3L		50.9						
P3L								19.6
P3W								12
P4L		11.9			15			17.9～18.8
P4W		14.4			15			18.4～19.3
M1L	15.2	13.6			13.7～14.2			18.9～19.5
M1W	16.5	15.7			14.1～17			21.3～21.4
M2L		15.6			15～16			19.7
M2W		18.5			20			23
M3L		14.1			13.4～15		16 *	17.1～17.7
M3W		15.6			15.9～18		19 *	19.7～20
dP3L	14.1							
dP3W	9.4							
dP4L	14.5							
dP4W	13.1							
cL				12.7				15.5～16.8
cW				10.4				12.5～15.4 +
p1L			11.7	11.6				13
p1W			6.4	7.0				10
p2L				15.3				13.3～16.3
p2W				7.1				7.2～8.8
p3L						11.2		24.1
p3W						6.1		12.3～13.6
p4L					18.4	14.6		23.1～23.2
p4W					10.4	7.5		12.5～13.9
m1L	15.6				15.6	13.2	17	18.7～21.1
m1W					11.7	9.6	13	14.9～15.1
m2L	17.5				16.3	16.0	17.5～18	21～21.3
m2W	13.0				14.3	11.3	13～15	17～17.5
m3L					17.5	14.2～17.3	22	20.8
m3W					13.0	10.2～12	13	16.2
dcL			7.6					
dcW			6.6					
dp2L			11.3					
dp2W			4.8					
dp3L			13.1					
dp3W			5.0					
dp4W			6.7					
D at p2			33.7	31.7		25		

缩写(Abbreviations) :D. **下颌骨深**(depth of lower jaw) ;L. **长**(length) ;W. **宽**(width) 。

Brachyhyops **其他各种的测量分别依**(The measurements of other species of *Brachyhyops* follow respectively) : 1) Colbert (1938) **和** Wilson(1971) ;2) **周明镇**(1958) ;3) Dashzeveg, 1976 ;4) Russell (1980) **和** Storer (1984) 。

* Dashzeveg (1976, p. 48) **测量表上的** M3 **的长** ×**宽为** 19 ×16 ,**但根据他的图** 3 **的测量** ,**其长** ×**宽为** 16 ×19 (The measurement of Dashzeveg (1976, p. 48) shows that L ×W of M3 are 19 ×16. However, according to the figure 3, L ×W of M3 are 16 ×19) 。

上面的比较表明,内蒙古短面猯在一些特点上,如颊齿的主尖较高而锐、齿脊较发育、具原脊、M3 后部和后齿带较退化以及下颌骨较深、前部下缘较陡等,与后期的更进步的属(如 *Entelodon* 和 *Archaeotherium* 等)较相似(Brunet, 1979),显得比 *B. yunnanensis*、*B. wyomingensis* 和 *B. trofimovi* 进步些。很可能内蒙古的短面猯代表该属的一个较进步的种,我们将它定名为内蒙古短面猯(*B. neimongolensis*)。从产出的层位和时代看,*B. yunnanensis* 产自云南路南路美邑组的上部,时代为中始新世晚期;*B. wyomingensis* 的时代为Duchesnean,也为中始新世晚期;*B. trofimovi* 产于阿尔丁鄂博组的下段,时代为晚始新世较早期;而 *B. neimongolensis* 的时代为晚始新世乌兰戈楚期,时代比上述三种稍晚。从下颌骨水平支较低、其前部较少缩短、下缘较少上斜以及颊齿的大小形态判断,*B. yunnanensis* 可能是上述三种中最原始的种。*B. viensis* 的下颌骨和颊齿的形态虽然与 *B. yunnanensis* 的相似,但颊齿尺寸要大许多。*B. viensis* 很可能代表较早从类似 *B. yunnanensis* 的种类分出的一支。

上述研究表明在始新世和渐新世时,在亚洲和北美之间存在动物群的迁徙和交流,而在亚洲与欧洲之间的交流直到早渐新世才发生。至于 Entelodontidae 到底是由何种动物起源,还有待于发现更多更好的材料。

A NEW SPECIES OF ENTELODONTIDAE (ARTIODACTYLA, MAMMALIA) FROM LATE EOCENE OF NEI MONGOL, CHINA

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Key words Shara Murun, Nei Mongol, late Eocene, Entelodontidae

Summary

While visiting the American Museum of Natural History (AMNH) in May and June, 2001, invited by Dr. R. H. Tedford, the authors were able to make a survey of the fossils collected by the 3rd Central Asiatic Expedition during the 1920s. Among them some undescribed specimens of Entelodontidae were recovered. They were labelled as found from late Eocene deposits of Nei Mengol in 1928. Eocene entelodontids were poorly known in Asia. These specimens are important not only because they represent a new taxon, but also they cast new light on the affinity between Asian and North American entelodonts.

Entelodontidae Lydekker, 1883

Brachyhyops **Colbert, 1938**

Eoentelodon Chow 1958, 30～36, fig. 1, p1. I

Brachyhyops was erected by Colbert (1938). The material of the type species (*B. wyomingensis*) consisted of a single skull at first. In 1958 Chow established another new genus, *Eoentelodon*, the type specimen of the genotype (*E. yunnanense*) being a single lower jaw. Later, Wilson (1971) referred some upper and lower jaws to *Brachyhyops wyomingensis*, considerably enhancing our knowledge of the genus *Brachyhyops*. Wilson first compared *Eoentelodon yunnanense*

with *Brachyhyops wyomingensis* , but limited his comparison by pointing their size difference. Dashzeveg (1976) described a new species of *Eoentelodon* , *E. trofimovi* , based on two lower jaws and a M3. He did not mention *Brachyhyops* , although his M3 was very close similar to that of *B. wyomingensis*. Russell (1980) was the first who clearly pointed out the great similarities between *Brachyhyops* and *Eoentelodon* , even tending to refer his *B.* ? *viensis* to the genus *Eoentelodon*. However , he did not take the step to synonymize the two genera. He apparently overemphasized the size difference and geographic separation of *B. yunnanensis* and *B. viensis*.

Having compared the specimens of both *Brachyhyops* and *Eoentelodon* mentioned above , we come to the same conclusion as Russell (1980) did. The material ever referred to the above two genera exclusively shares the following common features: there is an incipient posterior mental process; the anterior part of the lower jaw remains short; the symphysis reaches posteriorly to p3; the p3 and p4 are closely arranged; the paraconid and metaconid are separated on the lower molars. Further, we found that the M3 of *Brachyhyops wyomingensis* is also similar to that of *Eoentelodon trofimovi* in crown features. The size differences between *B. wyomingensis* (genotype of *Brachyhyops*) and *E. yunnanense* (genotype of *Eoentelodon*) is not so large as Russell (1980) once thought (vide Table 1). The cheek teeth of the former is only slightly larger than the latter and the length of m2 of both species are nearly the same. The cheek teeth of *E. trofimovi* are even larger than those of *B. wyomingensis*. All the above stated tends to show that *Eoentelodon* is a late synonym of *Brachyhyops*. Under the new conception the genus *Brachyhyops* includes four species: *B. wyomingensis* , *B. viensis* , *B. yunnanensis* and B. *trofimovi*.

Brachyhyops neimongolensis **sp. nov.**
(Figs. 1～4)

Holotype　A right upper jaw with P4 - M3 (AM 99666 ,field no. 666).

Referred specimens　A left upper jaw with dP3 - 4 and M1 , and a left lower jaw with m1 - 2 , which may belong to one same individual (AM 26264 ,field no. 666) ; an anterior part of right lower jaw with dc , p1 , dp2 - 4 (AM 99670 , field no. 668) ; and an anterior part of left lower jaw with c - p2 and root of p3 (AM 99671 , field no. 668).

Locality and horizon　Twin Obo , East Mesa , Shara Murun region , Nei Mengol , China ;late Eocene Ulan Gochu Formation.

Diagnosis　Medium-sized; lower jaw with deep horizontal branch , short anterior part and steeper anteroventral surface; c and lower premolars overlaped; cheek teeth with rather high and sharp main cusps and distinct lophs; upper molars trapezoid , with distinct protoloph and rather posteriorly located protocone; M3 with smaller paracone and protocone , hypocone and weak posterior cingulum.

Etymology　*Nei Mongol* is the province where the fossils were collected.

Description and dimension　(see Table 1 in Chinese text)

Comparison and discussion　The lower jaws from Nei Mongol have a short anterior part and two mental foramina. The symphysis reaches to p3 (or dp3). The p3 and p4 are closely arranged. The paraconid and metaconid are separated on lower molars. The P4 has two main cusps , paracone larger than the protocone; The upper molars have developed conules. All these features are those of *Brachyhyops*. However , the above specimens differ from all the other species of *Brachyhyops* (*B. wyomingensis* , *B. viensis* , *B. yunnanensis* and *B. trofimovi*) in having rather high and sharp main cusps and rather developed lophs on cheek teeth. In addition , they differ from *B. wyomingensis* and *B. viensis* in having trapezoid upper molars , with forming protoloph , and a more posteriorly located protocone; from *B. wyomingensis* and *B. trofimovi* in having trapezoid M3 with hypocone and weak posterior cingulum. They differ from *B. wyomingensis* in having a shorter and wider P4; from *B. yunnanensis* and *B. viensis* in having a higher horizontal branch and a steeper

anteroventral surface in lower jaw. All these show that the Nei Mongol specimens represent an advanced species of *Brachyhyops*, for which a new name, *B. neimongolensis*, is given. This is in accordance with its higher stratigraphic occurrence. The other three species are known from older deposits than *B. neimongolensis*. *B. yunnanensis* and *B. wyomingensis* are known from late middle Eocene and *B. trofimovi* from the lower part of the Ergilin-Dro Svita (early late Eocene). Although *B. neimongolensis* has some advanced features leading to later *Entelodon* and *Archaeotherium* (vide supra), the Nei Mongol species cannot be a direct ancestor of the later entelodonts. The shortening of the anterior part of the lower jaw in the new species precludes such possibility.

The foregoing discussion shows that the migration of the entelodonts between Asia and North America existed in Eocene and Oligocene and that between Asia and Europe occurred only in Oligocene.

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References

Brunet M, 1979. Les grands mammifères chefs de file de l'immigration Oligocène et le problème de la limite Éocène-Oligocène en Europe. Paris: Édit Fondation Singer-Polignac. 1～281

Chow M(周明镇), 1958. *Eoentelodon* —A new primitive entelodont from the Eocene of Lunan, Yunnan. Vert PalAsiat (古脊椎动物学报), **2**(1): 30～36

Colbert E H, 1938. Art. IV. *Brachyhyops*, a new bunodont artiodactyl from Beaver Divide, Wyoming. Ann Carnegie Mus, **27**: 87～108

Dashzeveg D, 1976. New data of Entelodontidae (Artiodactyla, Suiformes) from Oligocene of Mongolia. Paleontologia and biostratigraphia Mongolia, Trudy B, **3**: 47～50 (in Russian)

Russell L S, 1980. A new species of *Brachyhyops*? (Mammalia, Artiodactyla) from the Oligocene Cypress Hills Formation of Saskatchewan. Royal Ontario Mus Life Sci Occasional Paper, (33): 1～5

Storer J E, 1984. Fossil mammals of the Southfork Local fauna (early Chadronian) of Saskatchewan. Can J Earth, **21**: 1400～1405

Wilson J A, 1971. Early Tertiary vertebrate faunas, Vieja Group, Trans-Pecos Texas: Entelodontidae. Pearce-Sellards Ser, (17): 3～17